sodium is more depressing to the respiratory centre than evipal in their experience, but no twitching occurs, and the induction of anæsthesia is a little smoother, while the fall in blood pressure is less noticeable than with evipal. They give as contraindications (1) hepatic disease; (2) low blood pressure. The recumbent position is necessary; the use of any other barbiturates as premedication should be avoided.

Finally, Adams[6] reports extensively on his experiences with pentothal sodium. He finds it useful in a large range of cases, but is opposed to its employment in throat operations on the ground that interference with the airway and its failure to obliterate the pharyngeal and laryngeal reflexes make it unsuitable and dangerous, while infected blood or secretion in these areas is looked upon as a dangerous factor.

SUMMARY

1. This method has proved itself safe and efficient in our hands.

2. In contrast to the experiences of some clinics where intravenous anæsthesia is not accepted for children under 8 years of age, and especially in tonsil operations, our experiences have been reasonably satisfactory.

3. A warning should be given that competent anæsthetists familiar with venipuncture must be present, while an oxygen apparatus should be readily at hand in case cyanosis or respiratory depression should present itself in alarming degrees.

4. We are not ready to say that this method should displace the ordinary ones in use for healthy children, as the old adage "To leave old gods for new has never found much favour in my eyes", but in a selected type of case, such as those on which we have reported, we feel that intravenous anæsthesia offers a method of performing tonsillectomy and adenoidectomy operations with safety and comfort.

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SUCCESSFUL EXCISION OF A TUMOUR OF THE PINEAL GLAND*

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THE following is a complete report of a case of tumour of the pineal gland which has recently come under our care and presents some features of unusual interest.

CASE REPORT

Mrs. P.B., aged 25, presented herself to the medical out-patient department of St. Michael's Hospital on November 14, 1934, whence she was admitted to the medical service. Her chief complaints were headaches for ten months and amenorrhœa of fourteen months' duration.

Present illness.—She had felt perfectly well until January, 1934, when, following an attack of influenza, she noted the onset of headaches, which were worse in both parietal and occipital regions, and at first would come on at intervals of approximately one week. During the two months prior to presentation the time interval between headaches rapidly diminished, and instead of being present solely in the daytime, they became also nocturnal, would prevent the patient from going to sleep, and on occasion awaken her; finally, the headaches became constant. She complained of blurring of her vision only with the attacks, but more recently this had become continuous. Occasional vomiting, which was non-projectile and always preceded by nausea, was complained of for a period of three weeks. During the last three weeks she had noted dizziness, which became so marked that she was fearful of carrying her child. During the last week she noted tinnitus in the right ear. The amenorrhœa dated from the birth of her last child, September 21, 1933. Her period of gestation, delivery and puerperium presented no abnormalities.

Previous illnesses.—Anterior poliomyelitis at two and one-half years of age, which left her with a residual quadriceps paresis of the left leg. Functional inquiry revealed no abnormal findings, nor did careful physical examination, other than that directed to the central nervous system.

Scalp and cranium.—Normal in size, shape and contour. No evidences of injury; no tenderness; normal to percussion.

Cranial nerves.—(Olfactory).—No parosmias. Sense of smell, normal. (Optic).—Vision O.D. 20/20, O.S. 20/20. The visual fields were normal to the size of 4

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mm. white, red, yellow, green and blue test objects, as recorded by a De Zeng standard perimeter. Ophthalmoscopic examination revealed the presence of four dioptres of papillœdema bilaterally. The retinal veins were markedly congested. No retinal hæmorrhages were observed. (Oculomotor).—The right pupil was slightly larger than the left, both being slightly larger than mid-position. There was no reaction to light to direct or consensual stimulation. There was slight reaction to accommodation, but convergence was poor. There was a questionable tendency of the right eye towards external rotation; no difficulty in elevation of the eyeballs; no ptosis of the lids; no scintillating scotomata. (Trochlear).—Action of the superior oblique muscles, normal. (Trigeminal).—No paræsthesias; no sensory or motor disturbances. Corneal reflexes; bilaterally brisk. (Abducens).—Action of external recti, normal. (Facial).—No motor loss. (Acoustic).—No history of middle ear or mastoid disease. (*a*) *Auditory division*: Hearing within normal limits; right tinnitus present for two weeks. (*b*) *Vestibular division*: No nystagmus; dizziness had been present for some few weeks; the caloric reactions were normal. (Glossopharyngeal, vagus, spinal accessory, hypoglossal).—No evidence of involvement of any of these nerves.

Neck.—No opisthotonos. Brudzinski's test was negative.

Upper extremities.—No loss of power or atrophy. No demonstrable abnormalities of touch, pain and temperature sensations. Joint-muscle-tendon sensations, normal.

Reflexes.—The biceps, triceps, radiocarpal and ulnocarpal reflexes were present on both sides.

The finger to nose test was carried out accurately; the finger through ring test was performed without difficulty; no dysdiadokokinesia.

Abdomen and back.—Normal in appearance. Abdominal reflexes were present and active; no sensory changes; and rectal sphinctre was normal in tone; no incontinence of bladder or bowel.

Lower extremities.—Left residual quadriceps paralysis from early anterior poliomyelitis. The right leg presented no motor abnormalities. No demonstrable sensory change present.

Reflexes	*Right*	*Left*
Knee jerk	++	–
Knee clonus	–	–
Oppenheim-Gordon	–	–
Arnold	–	–
Ankle jerks	+	+
Ankle clonus	–	–
Babinski	–	–

No demonstrable abnormalities of coordination.

Topographical examination.—Frontal lobes.—There were no evident mental changes. The patient was bright and cooperative. There was no apraxia; no subversive zone signs, or aphasia. *Parietal lobes.*—No astereognosis; no subversive zone signs. *Pre- and post-rolandic gyri.*—No motor or sensory changes. No epileptiform seizures. *Occipital lobes.*—No scintillating scotomata; no visual field defect. *Temporal lobes.*—No "dreamy states"; no visual field defect. *Angular gyri.*—No evidence of involvement. *Hippocampal gyri.*—No uncinate fits; no subjective disturbances of taste. *Cerebellum.*—No ataxia, dysdiadokokinesia, asynergia, past-pointing, nystagmus, astasia or staggering. *Hypophysis.*—No signs of dyspituitarism; attitude of head, normal. There was no evidence of aphasia, either motor or sensory.

Laboratory findings.—Urinalysis: specific gravity, 1.020; reaction, acid; albumin, negative; sugar, negative; microscopically, negative. Red blood count, 4,500,000; hgb., 92 per cent (Sahli); white blood count, 12,300 per c.mm.; polymorphonuclear leukocytes, 59 per cent; lymphocytes, 41 per cent; blood chlorides, 782 mg. per 100 c.c. Cerebrospinal fluid: pressure, 15 mm. Hg.; colour, clear; cell count, 3 lymphocytes per c.mm.; globulin, negative; Wassermann, repeatedly negative; Kahn, repeatedly negative; colloidal benzoin, normal curve as also for the colloidal gold test.

X-ray examination.—Stereoscopic x-ray plates were made of the skull, which showed evidence of decalcification and thinning of the floor of the sella turcica, associated with atrophy of the posterior clinoid processes.

Summary of positive findings.—(1) Headache; (2) papillœdema; (3) vomiting; (4) bilateral Argyll-Robertson pupils.

Clinical diagnosis.—Upon these findings the clinical diagnosis was tumour of the pineal gland. (E.F.B.)

On November 23, 1934, the woman was transferred to the surgical service, where further investigation was carried out (D.W.P.).

Ventricular estimation and pneumoventriculograms were done, revealing an internal hydrocephalus allowing a 60 c.c. air replacement. The x-ray studies following this revealed the internal hydrocephalus found during ventricular estimation. The third ventricle could not be visualized. A number of very light calcifications were visible, scattered over an area approximately one inch in length, which corresponded roughly to the position normally occupied by the pineal gland.

With this confirmatory finding, the diagnosis of a tumour of the pineal gland was felt established, and accordingly, operation for the excision of the tumour through an original approach was planned and carried out on December 3, 1934.

OPERATION

A large, left, parieto-occipital osteoplastic craniotomy flap with a temporal pedicle was turned down. The incision for this commenced above the mastoid process, and extended posteriorly along the upper margin of the lateral sinus to just above the torcular Herophili, thence anteriorly, just lateral to the mid-line, to a point beyond the vertex, thence inferiorly to the temporal fossa. A similarly shaped dural flap was displaced inferiorly. The lateral ventricle was then tapped and the cerebrospinal fluid aspirated. This allowed upward dislocation of the occipital lobe, and the approach to the tumour was begun along the upper surface of the tentorium cerebelli. Proceeding carefully, it was possible to elevate the occipital lobe and, along with it, the vein draining the visual cortex as it emerged from the anterior end of the calcarine fissure. This was accomplished without damage to the vein. The tentorial ring was thus reached and somewhat depressed. It was now possible to retract very gently the large veins about the peduncle laterally and, with the greatest care, the great vein of Galen was retracted upwards and medially, bringing into view the splenium of the corpus callosum. The entrance to the third ventricle was still blocked by a veil of capillaries of the choroid plexus. A fine probe was allowed to fall between the meshes of the plexus into the ventricle. The entrance so made was very gradually enlarged, permitting a final exposure of the third ventricle approximately 4 cm. in diameter. The inferior colliculi of the corpora quadrigemina were thus exposed and on further elevation, without division of the splenium, the tumour of the pineal gland was found overlying the superior colliculi. It measured approximately 3 and 3.5 cm. in length and breadth respectively, and was some 2 cm. in thickness. It appeared to be fairly well encapsulated, was of a reddish brown colour, and was spongy in consistency. The tumour was then dissected up from the quadrigeminal plate and found to have an anterior attachment represented by the pineal stalk from which it was removed. On completion of the removal no further tumour mass appeared to be present, and no difficulty in hæmostasis was encountered. The third ventricle was then filled with saline, the dislocated occipital lobe replaced, and the dura closed with fine silk sutures. The osteoplastic flap was replaced, and the scalp closed in layers without drainage. A 500 c.c. transfusion of citrated blood was given during the operation. Her condition throughout the operation was excellent.

The anæsthetic employed was intratracheal nitrous oxide and oxygen, delivered through the Heidbrink apparatus; the operating time was three hours and forty-five minutes. Her pre-operative blood pressure was 118 systolic and 75 diastolic. It remained virtually unchanged throughout the procedure.

She regained consciousness in the evening of her operation, and it was seen that the pupils reacted to light, both to consensual and direct stimulation. For a few days there was some moderate nominal aphasia which gradually cleared up. The pupils continued in their reactions to light. There was no visual field defect, with the exception of a slight concentric diminution which required two weeks before returning to normal. She was discharged from hospital on December 22, 1934, having had no return of her headache or vomiting. She could read very fine print. There was no evidence of any pathological change on careful neurological examination. Her menstrual periods returned two weeks after operation and were regular and normal in every way until she again became pregnant.

She has been followed in the out-patient department from the date of discharge from hospital but no evidence of any recurrence existed on final examination March 21, 1938, *i.e.*, 3½ years after her operation.

She was delivered of a full term normal child on October 14, 1936. Her pre-natal period and puerperium were normal as has been her subsequent course.

Pathological report.—The tumour was encapsulated, having a slightly nodular surface; it was reddish brown in colour and measured 2 by 1.5 cm. The pathological diagnosis, made by Dr. William E. Magner, Pathologist of St. Michael's Hospital, Toronto, was that this represented an ependymal glioma of the pineal gland.

Blocks of the tumour tissue were sent to Prof. James Ewing in New York and Prof. E. A. Linell, Professor of Neuro-pathology at the University of Toronto. The latter's report on three blocks of tissues is as follows.

"*Microscopical report.*—Blocks A.B.C. stained with (1) hæmatoxylin and eosin; (2) Mallory's connective-tissue stain; (3) Mallory's phosphotungstic acid; (4) cresyl violet.

"Block A.—The hæmatoxylin and eosin section shows the tumour to be made up of rounded cells equally spaced, containing a centrally placed dark-staining nucleus. In some areas the tumour nuclei are surrounded by pink-staining cytoplasm, whereas in other areas the nuclei are surrounded by a clear-staining halo, which is suggestive of oligodendroglia, but may represent in this instance œdematous swelling of the cytoplasm of the tumour cells. Separating the masses of tumour cells are areas of pink-staining fibrillary material, suggestive of the matrix of the normal pineal gland. The vascularity of the tumour tissue is greater than that of the normal pineal, and there is a considerable amount of free operative hæmorrhage throughout the tumour tissue. Under high magnification the nuclei are seen to be round or oval in shape and comparatively uniform in size. With Mallory's connective-tissue stain a considerable amount of blue-staining fibrous reticulum is seen scattered through the tumour tissue, this fibrous tissue matrix having its origin mainly from the walls of blood vessels. The morphological characters of the tumour cells are well shown with cresyl violet under high magnification. A few of the nuclei stain hyperchromatically, and a very occasional mitotic figure can be seen. No calcium deposit can be seen in the tumour tissue.

"Block B.—These sections of specimen 2 show the tumour tissue to contain considerable quantities of fresh operative hæmorrhage. The cytoplasm of the tumour cells is œdematous. The nuclei are rounded and are uniform in shape and size. They tend to be separated by vacuoles of œdema suggesting, in some places, a reticulum like that of astrocytoma. This appearance is even more marked in the cresyl violet section. There is no evidence of columnar epithelial elements in the tissue of this block, nor of rapid proliferation of the tumour cells. No mitotic figures can be seen.

"Block C.—These sections of specimen 3 show somewhat less œdema of the tumour tissue. Small operative hæmorrhages are visible, as in previous blocks. The cellular elements in this block tend to show some arrangement around blood vessels. The nuclei are again uniform in shape and size. They are spherical or slightly oval in shape, with a light chromatin content. The cytoplasm of individual cells is hard to differentiate, the nuclei being set in a uniformly pink-staining cytoplasm. These morphological characters are not incompatible with normal pineal parenchyma. There is little evidence of mesoblastic connective-tissue fibres running through the tumour tissue, but the tumour shows a well marked fibrous-tissue capsule. No columnar epithelial cells can be seen in this block and, under high magnification, with cresyl violet, the tumour-cell nuclei are uniform in shape and size. Mitotic figures are not seen.

"The sections show tumour tissue which has the morphological characters of pineal parenchyma. The tumour tissue is œdematous and in these situations a reticular appearance suggestive of astrocytoma is seen. The nuclei of the tumour cells are vesicular or slightly oval in shape. They have a light chromatin content and are surrounded by pink-staining cytoplasm which shows ill-defined edges. The most visible tumour cells surround the blood vessels of the tumour. There is no histological evidence of malignancy in the tissue received. There is a moderate amount of fresh operative hæmorrhage throughout the tumour tissue.

"Note.—A section received from Doctor Magner shows a small area of the section to have cells the nuclei of which stain somewhat more darkly, and in places have an arrangement suggestive of columnar epithelium. These areas may represent either inclusion of hyperplastic ependymal or a more primitive type of pineal parenchymatous tissue."

Doctor Ewing's opinion on microscopic slides sent to him by Doctor Magner is that the tumour is an adeno-carcinoma of the pineal gland.

DIAGNOSTIC AND THERAPEUTIC CONSIDERATIONS

The problem of diagnosis of these tumours of the pineal gland which, it will be recalled, has been considered the remnant of the third, lateral or reptilian "eye", has until recent years been one largely of academic interest, the vast majority of the tumours being found upon the autopsy table. More recently, however, localizations have been more encouraging.

In the greatest number of cases, tumours of this gland present the symptoms and signs of increased intracranial pressure, namely, headaches, vomiting, and choking of the optic discs, and when localizing signs are present they are usually those attributable to the syndrome of the quadrigeminal plate and associated compression signs of the underlying structures of the mesencephalon. The majority of cases as reported, both those submitted to surgical intervention and those diagnosed at necropsy, showed clinical manifestations ascribed to quadrigeminal plate involvement. The more common findings include the presence of ptosis, loss of upward movement of the eyes, other extra-ocular palsies, and fixation with dilatation of the pupils. Tinnitus may also be a symptom, with associated auditory defects due to involvement of the in-

ferior colliculi. These latter are of later development and represent caudal progression. The case here described showed tinnitus for only two weeks prior to the operation. Cerebellar manifestations due to superior cerebellar peduncle involvement may also be present. Disturbances of an endocrine nature, such as the syndrome of Pellizzi, are in no way essential to the diagnosis of pineal gland tumours. In none of the ten cases reported by Dandy was endocrine disturbance present.

The case herein reported presented the problem of locating a space-occupying lesion in the brain. Headache, vomiting and papilloedema suggested the presence of a new growth. The only significant neurological findings were those related to the pupils, which presented the bilateral Argyll-Robertson syndrome. In the absence of syphilis, and taking into consideration the fact that the visual acuity was such that one could assume that conduction of light by the optic nerves and tracts was adequate, it was concluded that a lesion must be present in the midline in the region of the superior colliculi. By exclusion, signs were not present which would permit the diagnosis of a lesion in another location of the cerebrum or cerebellum. A lesion, therefore, in the region of the quadrigeminal plate would explain the presence of the demonstrated internal hydrocephalus, as well as the defect in pupillary reaction. It was felt that if a tumour existed it was probably in the pineal gland. It must not be forgotten that we were seeing the case before the usual complete syndrome of quadrigeminal plate involvement was present. The scattered faint shadows in the pineal gland region noted in the x-ray, occupying an area larger than that of the normal calcification, seemed confirmatory of our impression. With the exception of amenorrhœa which had persisted from the birth of her child, fourteen months previously, no evidence of endocrine dyscrasia was present in this case.

In reporting this case, we feel that it is of singular interest in that it presented the fewest signs upon which a diagnosis of a tumour of the pineal gland could be made. In the absence of syphilis the loss of pupillary reaction served as an important clue to the location of the lesion. In those cases in which cerebellar signs are prominent greater difficulty in diagnosis would, we believe, be encountered in regard to the exclusion of cerebellar disease. This probably accounts for those cases in the literature where a cerebellar exploration was carried out with disappointing negative findings. Absence of cerebellar signs in this case, therefore, was of material assistance in the diagnosis and selection of operative approach.

This case is of unusual interest in that it represents the first pre-operative diagnosis made upon and the first entirely successful excision of a pineal gland tumour.

A comprehensive review of the literature upon this subject will be found in Dr. Van Wagenen's review in *Surg., Gyn. & Obst.*, 1937, **53**: 216. See also Harrax and Bailey, *Archiv. of Neurol. & Psychiat.*, 1925, **13**: 423; *Idem*, 1928, **19**: 394.

We wish to express our gratitude to Dr. George E. Wilson, Surgeon-in-Chief, St. Michael's Hospital, and to Dr. Harris McPhedran, Department of Medicine, St. Michael's Hospital, for their kindly permission to carry out this work upon this patient and for their helpful cooperation throughout.

SURGICAL TREATMENT OF CORONARY DISEASE.—A. Ochsner and M. de Bakey give the results obtained by the various surgical procedures used in the treatment of 172 cases of coronary disease. There are 3 main methods of surgical attack: by operation directed at the sympathetic nervous system, by thyroidectomy, and by the development of a collateral blood supply to the heart. The first procedure is based upon interruption of cardiosensory and motor pathways. Sympathectomy is indicated for patients who are obviously poor risks. These are usually elderly people with marked sclerotic changes and fibrotic myocardial degeneration. It is suitable for patients who have very severe pain, or in whom the angina is aggravated by emotional disturbance rather than by effort, and for those cases in which the basal metabolic rate is very low. Paravertebral alcohol injection has an almost negligible mortality and the technique, which is relatively simple, is fully described. Thyroidectomy has a much higher mortality, but the proportion of successful results is also higher. This method of treatment is indicated for patients who have a normal or high basal metabolic rate, who are relatively good risks, and whose angina is one of effort rather than of emotion. Treatment of coronary disease by the development of a collateral circulation has a 50 per cent mortality and is suitable for patients who have had a recent thrombosis, or show little evidence of arteriosclerosis or fibrotic muscular degenerative changes. It is suggested that improved technique and a careful selection of cases may reduce the high mortality.—*New Orleans Med. Surg. J.*, March, 1938, p. 520. Abs. in *Brit. M. J.*